

CHICAGO SANITARY AND SHIP CANAL, BUTTERFLY DAM  
Illinois Waterway River Mile 293.1  
Lockport vicinity  
Will County  
Illinois

HAER IL-197-B  
*IL-197-B*

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

HISTORIC AMERICAN ENGINEERING RECORD  
National Park Service  
U.S. Department of the Interior  
1849 C Street NW  
Washington, DC 20240-0001

**HISTORIC AMERICAN ENGINEERING RECORD**  
**CHICAGO SANITARY AND SHIP CANAL, BUTTERFLY DAM**

**HAER No. IL-197-B**

**Location:** Illinois Waterway River Mile 293.1, Lockport vicinity, Will County,  
Illinois  
UTM – Latitude: 41.595056; Longitude: -88.065024

**Present Owner:** U.S. Army Corps of Engineers

**Present Use:** Removed after 1984 as part of the Lockport Lock Major Rehabilitation Project

**Significance:** The Butterfly Dam was built to help control the flow of water in the Chicago Sanitary and Ship Canal. Sanitary District engineers based the design of the Butterfly Dam on the butterfly valve, which rotates on a central axis. When completed in 1907, the Butterfly Dam was reportedly the only one of its type.

**Historian:** Justine Christianson, HAER, 2009

**Project Information:** The Chicago Sanitary and Ship Canal Recording Project was undertaken during the summer of 2009 by the Historic American Engineering Record (HAER), a division of the National Park Service, U.S. Department of the Interior. The project focused on a 2.2-mile-long section of the canal between Illinois Waterway River Miles 291.1 to 293.3. The U.S. Army Corps of Engineers sponsored the project with research assistance and access provided by the Metropolitan Water Reclamation District of Greater Chicago. The field team consisted of Dana Lockett, HAER Architect and Project Leader; Nicole Martineau, HAER Intern, and Justine Christianson, HAER Historian. Jet Lowe, HAER Photographer, produced the large format photographs.

For additional information see:

Chicago Sanitary and Ship Canal	HAER No. IL-197
Chicago Sanitary and Ship Canal, Lockport Controlling Works	HAER No. IL-197-A
Chicago Sanitary and Ship Canal, Lockport Power House and Dam	HAER No. IL-197-C
Chicago Sanitary and Ship Canal, Lockport Lock	HAER No. IL-197-D

For photographs of the Butterfly Dam in 1979, see Lockport Historic District, Chicago Sanitary & Ship Canal, Butterfly Dam, HAER No. IL-16-C.

## Part I. Historical Information

### A. Physical History:

1. **Date of Construction:** 1906-1907
2. **Architect/Engineer:** Sanitary District personnel involved in the design of the dam included Isham Randolph, Chief Engineer; C.R. Dart, Bridge Engineer; and S.T. Smetters, Assistant Bridge Engineer.
3. **Builder/Contractor/Supplier:** Strobel Steel Construction Company of Chicago built the structure.
4. **Original Plans:** Although the Butterfly Dam has been removed, a number of drawings, photographs, and descriptions exist to help piece together its original appearance. Since the canal was to be used for navigation, in addition to diluting and removing sewage from Chicago, "it was necessary that the headworks should form no obstruction" in the channel.<sup>1</sup> Consequently, when the Butterfly Dam was not in use, the dam leaf sat between concrete piers parallel to the canal walls in the center of the channel, leaving an 80' clearance on either side. A description from the 1906 *Proceedings of the Board of Trustees of the Sanitary District of Chicago* provides a complete picture of the structure.

The dam consists of a steel leaf about 184 feet long and 30 feet high constructed of horizontal riveted girders with an upstream face of planes riveted to the girders. Such leaf is to be pivoted at the center by means of an upper and a lower pivot shaft, the lower pivot secured in a steel anchorage, bedded in concrete in the floor of the Canal, and the upper pivot to engage the floor of a riveted brace span above the leaf. The brace span is to be located parallel with and on the center line of the Main Channel, each end to rest on a masonry protection and anchorage, such protections dividing the Main Channel into two channels, each 80 feet wide in the clear. The leaf, when open, is parallel with the channel and directly beneath the brace span; when closed, it extends across the channel to form a dam by means of which the flow of water can be cut off and diverted through the present controlling works.<sup>2</sup>

The entire leaf measured 184' long and 30' high and consisted of seven horizontal riveted girders measuring 90' long that extended on either side of a central pivot measuring 32-½' long. The pivot was reportedly the largest ever assembled in Chicago and weighed 75 tons. The upstream face of the leaf was clad in riveted

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<sup>1</sup> "The Movable Dams and Lock at the Power Plant on the Chicago Drainage Canal," *Engineering News* 60, no. 20 (November 12, 1908): 512.

<sup>2</sup> *Proceedings of the Board of Trustees of the Sanitary District of Chicago from January 1, 1906 to December 31, 1906* (Chicago: Fred Klein Co., Printers, 1907), 11688.

steel plates. Six butterfly valves were located in rectangular openings on either side of the central pivot, each measuring 6'-4 1/2" x 4'-1". An electric motor operated the butterfly valves, which were used to move the leaf in the channel. The top of the central pivot connected to a steel Pratt truss bridge (also called the brace span on drawings) extending between two concrete piers located in the center of the channel. These concrete piers, designated the north and south piers, protected the ends of the movable leaf when the dam was open as well as supported the brace span. The bottom of the pivot rested on a steel frame anchored to the rock bottom of the channel.<sup>3</sup>

A machinery house located at the center of the brace span enclosed the operating machinery. Measuring about 12'-8" x 27'-4", the building had a hipped roof with galvanized iron roofing and was clad in white pine drop siding. There were "two mullioned windows in each side and a single window at each window," for a total of ten windows. Access to the building was provided by double doors at each end that measured 5'-6" x 7'.<sup>4</sup>

A tunnel bored under the channel connected the west side of the canal to the Butterfly Dam. This was necessary because when the dam was in the open position, parallel to the channel banks, there was no way to reach it. At each end of the tunnel were shaft houses. As suggested by its name, "West Shaft House" was located on the west bank of the channel. The brick building measured 15'-6" x 15'-6" and had 9"-thick walls and a pressed brick cornice. Five windows, each divided into four lights and topped by an arch, and one door, measuring 3'-2" x 7'-6", punctuated the walls. The building had a pyramidal hipped roof, which a drawing specified as having either Ludowici or Celadon red roof tiles. The interior of the west shaft house had a cement floor with a well hole for the pump, which was necessary to keep the tunnel dry. A steel stairway with cast-iron treads and landings provided access to the tunnel. At the other end was the "East Shaft House" located on the north pier in the channel. The East Shaft House was of similar style and construction to its companion. The dimensions varied slightly to accommodate its position on the concrete pier so the building measured 15'-6" x 8'. The brick house had a hipped roof, three windows, and one door, and it was equipped with a steel stairway to provide access to the tunnel.<sup>5</sup>

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<sup>3</sup> "Movable Dams and Lock at the Power Plant," 512; Edward Wegmann, CE, *The Design and Construction of Dams, Including Masonry, Earth, Rock-Fill, Timber and Steel Structures, Also the Principal Types of Movable Dams* (New York: John Wiley & Son Inc., 1922), 364-365; William Hard, "Building a Butterfly Dam," *The Technical World Magazine* VII, no. 6 (August 1907): 624-625, 627; Isham Randolph, "The Sanitary District of Chicago, and the Chicago Drainage Canal: A Review of 20 Years of Engineering Work," *Engineering News* 62, no. 4 (July 22, 1909): 92.

<sup>4</sup> *Proceedings of the Board of Trustees of the Sanitary District of Chicago*, 1906, 11707.

<sup>5</sup> Sanitary District of Chicago, Water Power Development, "Emergency Butterfly Dam, Tunnel & Shaft Houses," June 1906, Sheet No. 8; Sanitary District of Chicago, "Map Showing Location of Butterfly Dam," December 1908, both available from the Metropolitan Water Reclamation District of Chicago, hereafter cited as MWRD. See also *Proceedings of the Board of Trustees of the Sanitary District of Chicago*, 1906, 11693 and 11708.

## 5. Alterations and Additions:

The machinery house had to be lengthened in September 1907, but it is unclear why this was undertaken or how the resulting addition changed the original structure.<sup>6</sup>

Both shaft houses and the machinery house had been removed by 1979.<sup>7</sup> The Metropolitan Sanitary District of Greater Chicago (as the Sanitary District was then known) and the Department of the Army divided responsibilities for the maintenance and operation of the canal and structures in 1984. The agreement stated that the Butterfly Dam would be removed as part of the Lockport Lock Major Rehabilitation Project, and this took place at some point after 1984.

## B. Historical Context:

According to Sanitary District Chief Engineer Isham Randolph, the construction of the Chicago Sanitary and Ship Canal created a “great body of water” located “at an elevation of nearly 40 ft above the level of a large area in Joliet, about two miles away.”<sup>8</sup> The level of this pool (known as the Lockport Pool) was essentially at the height of Lake Michigan and excess water could force the reversal of the canal’s waters back into Lake Michigan. In addition, there were concerns about cities located downstream being flooded in the event of a heavy rainfall. While the Controlling Works, said to be “of ample strength” and equipped with a bear-trap dam and sluice gates, had been built to regulate the flow of water in the channel, “to make assurance double sure” the Butterfly Dam was built from 1906 to 1907.<sup>9</sup> The dam could shut off the flow of water down the channel to the Lockport Power House and instead force its discharge upstream at the Lockport Controlling Works and into the Des Plaines River channel.

Strobel Steel Construction Company of Chicago and Chicago Bridge & Iron Works of Chicago submitted bids for the dam in July 1906, with Strobel Steel being awarded the contract. Strobel Steel estimated the construction cost at \$242,000. Materials used in its construction included steel, cast iron, phosphor and Tobin bronze, pine timber, and Portland cement. The Sanitary District put the dam into operation at 3:00 in the morning on August 27, 1907, although it is not clear how often it was actually used.<sup>10</sup>

The Butterfly Dam was a unique structure, reportedly the “the only structure of its kind.”<sup>11</sup> In a rather florid article published in 1907 in *The Technical World Magazine*,

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<sup>6</sup> *Proceedings of the Board of Trustees of the Sanitary District of Chicago from January 1, 1907 to December 31, 1907* (Chicago: Fred Klein Co., Printers, 1908), 688.

<sup>7</sup> For images, see Lockport Historic District, Chicago Sanitary & Ship Canal, Butterfly Dam, HAER No. IL-16-C.

<sup>8</sup> Isham Randolph, “The Sanitary District of Chicago, and the Chicago Drainage Canal: A Review of Twenty Years of Engineering Work,” 1909, 9.

<sup>9</sup> Wegmann, *Design and Construction of Dams*, 364.

<sup>10</sup> *Proceedings of the Board of Trustees of the Sanitary District of Chicago*, 1906, 11693; Randolph, “The Sanitary District of Chicago, and the Chicago Drainage Canal: A Review of Twenty Years of Engineering Work,” 9.

<sup>11</sup> Wegmann, *Design and Construction of Dams*, 364.

the dam was described as “one of the greatest curiosities in that museum of curiosities, the Chicago Drainage Canal.”<sup>12</sup>

## Part II. Structural/Design Information

### A. General Description:

The Butterfly Dam was removed after 1984 but had not been in use for some time prior. It was probably rendered obsolete by the construction of the Chicago Harbor Lock from 1936-38 at the junction of the Chicago River and Lake Michigan. The only remnant of the structure is the concrete pad on which the west shaft house was located, and the concrete abutments on either side of the channel. The tunnel may still be extant but is currently not accessible.

1. **Character:** Removed

2. **Condition of Fabric:** Removed

### B. Construction:

Strobel Steel built the structure, but no additional information has been found about the methods used to build it.

### C. Mechanicals:

Sanitary District Chief Engineer Isham Randolph described the basic operation of the dam, which was based on the butterfly valve.

To close the channel, the dam is started by rack and pinion mechanism which throws it into the current. At this time the six valves (A) are opened and the six valves (B) are closed, so that the current acts against a larger closed area on the (B) side than on the (A) side. The dam is then swung across the stream..., thus closing the channels. To open the channel again for navigation, the valves (B) are opened and the valves (A) are closed. This throws the greater pressure on the (A) side which swings the dam back to this open position. The operating mechanism is at the center of the bridge and the motive power is electricity.<sup>13</sup>

The movable leaf of the dam turned in a clockwise direction. When the leaf needed to be turned into the channel to stop the flow of water, the six valves in the section of the leaf turning upstream were opened, and a rack and pinion mechanism powered by an electric motor were engaged. The result of these two actions was that the downstream half of the leaf received the force of the water pressure, thus causing it to close. A lock at the east abutment kept the leaf in place across the channel while also receiving the pressure of the gate and transmitting it to the concrete abutment and chamber walls. When water could

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<sup>12</sup> Hard, “Building a Butterfly Dam,” 624.

<sup>13</sup> Randolph, “The Sanitary District of Chicago, and the Chicago Drainage Canal,” *Engineering News*, 92.

flow down the channel again, the valves would be opened in that section of the leaf swinging upstream. After the lock had been released, “the unbalanced pressure against the other leaf will swing the dam with very little assistance from the operating machinery.”<sup>14</sup>

**D. Site Information:**

The Butterfly Dam was located in the extension to the Chicago Sanitary and Ship Canal, just south of the Controlling Works and the original canal terminus.

**Part III. Sources of Information**

**A. Primary Sources**

Hard, William. “Building a Butterfly Dam.” *The Technical World Magazine* VII, no. 6 (August 1907): 623-629.

“The Movable Dams and Lock at the Power Plant on the Chicago Drainage Canal.” *Engineering News* 60, no. 2 (November 12, 1908): 512-518.

*Proceedings of the Board of Trustees of the Sanitary District of Chicago from January 1, 1906 to December 31, 1906.* Chicago: Fred Klein, Co., Printers, 1907.

*Proceedings of the Board of Trustees of the Sanitary District of Chicago from January 1, 1907 to December 31, 1907.* Chicago: Fred Klein, Co., Printers, 1908.

Randolph, Isham. “The Sanitary District of Chicago, and the Chicago Drainage Canal: A Review of Twenty Years of Engineering Work.” 1909. Also in *Engineering News* 62, no. 4 (July 22, 1909): 90-94.

The Sanitary District of Chicago. “Engineering Data on the Sanitary District of Chicago.” June 1910.

**Drawings, available from Metropolitan Water Reclamation District of Greater Chicago**

Sanitary District of Chicago. Water Power Development, “Emergency Dam near Controlling Works.” September 1905.

\_\_\_\_\_. Water Power Development, “Emergency Butterfly Dam, Tunnel & Shaft Houses.” June 1906. Sheet No. 8.

\_\_\_\_\_. Water Power Development, “Emergency Butterfly Dam, Movable Leaf, Operating Machinery.” January 26, 1907. Sheet No. 25.

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<sup>14</sup> Quote from “Movable Dams and Lock at the Power Plant,” 512; Wegmann, *Design and Construction of Dams*, 365.

Sanitary District of Chicago, drawn by Tho. F. Parry. "Map Showing Location of Butterfly Dam." December 1908.

**B. Secondary Sources**

Scott, Branden K., Bear Creek Archeology, Inc. "Chicago Sanitary and Ship Canal Historic District." National Register of Historic Places Nomination Form. Draft. May 2009.

Wegmann, Edward. *The Design and Construction of Dams, Including Masonry, Earth, Rock-Fill, Timber and Steel Structures, Also the Principle Types of Movable Dams*. New York: John Wiley & Son, Inc., 1922.

**C. Likely Sources Not Yet Investigated**

Research was conducted at the Metropolitan Water Reclamation District of Greater Chicago's archives. The engineer reports have been subpoenaed and were unavailable at the time of the research trip in summer 2009. Additional information about the design and construction of the Butterfly Dam may be in those reports.